





Tools, Tips and Techniques to Speed Lighting Surveys & Audits

Developed by Effective Lighting Solutions
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For More Information

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Don't forget to fill out and drop off your session evaluations!



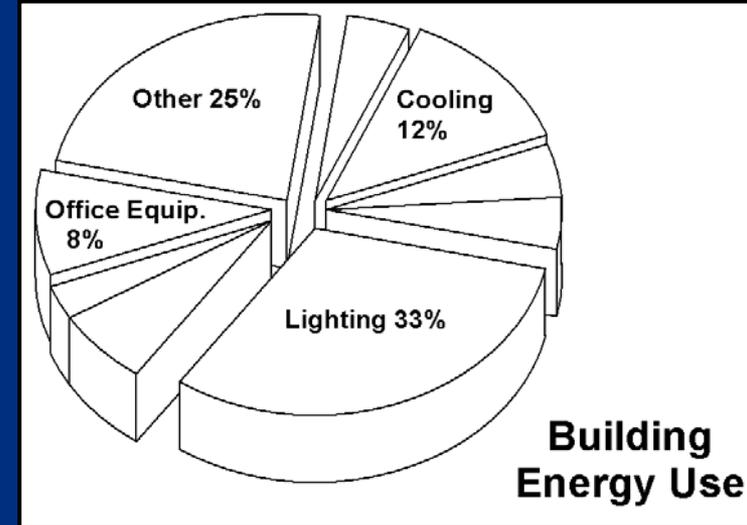
Survey or Audit?

- Survey
 - Walk-thru, looking for min number of solutions
 - “Hammer/Nail” Solutions – when all you’ve got is a hammer, then everything looks like a nail!
 - Lamp/ballast retrofits
 - PIR WB
- Audit
 - Comprehensive, more solution options
 - Usually more savings
 - Measurements – light level, occupancy



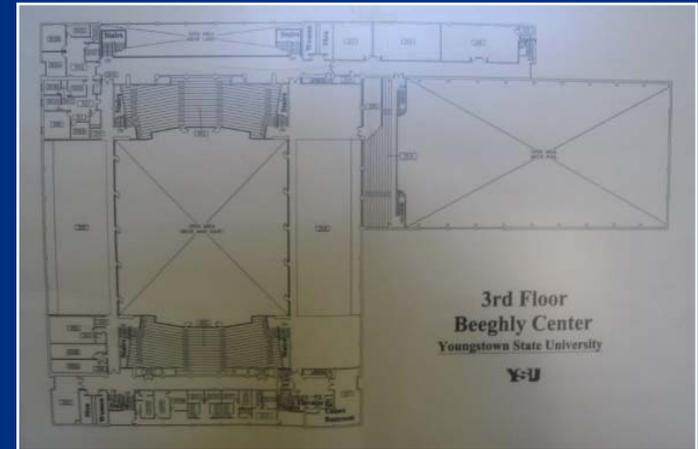
Why Do Lighting Audits?

- Lighting represents large portion of building energy
- Affects other building systems (HVAC)
- Looking for:
 - Energy savings
 - Improvement opportunities
 - Sustainable solutions



Pre-Audit Data Collection & Prep

- Building layout
 - Copy of evacuation plan
 - Keep track of areas audited
- Electric bills
 - At least 1 year
- Rate schedule
- Payback requirement



Pre-Audit Prep

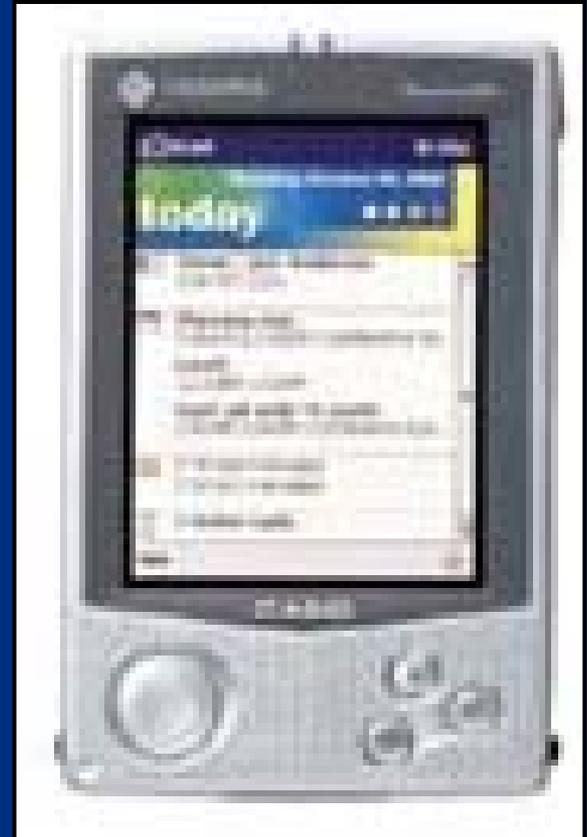
- Prepare forms PDA/paper
 - Excel[®] spreadsheet
- Organize audit team
 - Review form
- Review safety rules & special clothing
 - Hardhats, safety glasses, steeltoe shoes, etc
- Gather audit tools



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Audit Tool: PDA or Pocket PC

- Hand-held PC e/w Windows CE[®] & Excel[®]
- Stylus speeds data entry
- Cut & paste helps for similar spaces or fix types
- Download to PC or LT for analysis & reports





Audit Tool: Digital Camera

- Record fixture types, layouts and conditions
- 5 megapixels (min)
- Optical zoom
 - Fixture closeups
- Download to PC or LT
- Use for visual memory & report





Audit Tool: Cell Phone

- “Where are you?”
- “Break time!”
- Call facility POC
- Call security for access
- Call for “Help!”
- Near future – iPhone 3G
 - SS, Camera, GPS, and Phone



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Estimating Hours of Use

- No single hours of use for entire building
- Ask key personnel
- Look for posted hours
 - Library
 - Clinic
- Night drive-by
 - Verify real hours of use!

<i>Main Exchange Hours of Operation</i>	
<i>Monday</i>	<i>0900 - 1900</i>
<i>Tuesday</i>	<i>0900 - 1900</i>
<i>Wednesday</i>	<i>0900 - 1900</i>
<i>Thursday</i>	<i>0900 - 1900</i>
<i>Friday</i>	<i>0900 - 1900</i>
<i>Saturday</i>	<i>0900 - 1900</i>
<i>Sunday</i>	<i>1200 - 1800</i>



Describing Fixtures

- Lamp type
 - Incandescent, Fluorescent, CFL, HID
- Nominal size (1x4, 2x2, 2x4, 6” dia, etc.)
- Number of lamps per fixture
- Mounting
 - Wall, ceiling (recessed, SM, PM)
- Light control
 - None (open), lens, louver, baffle

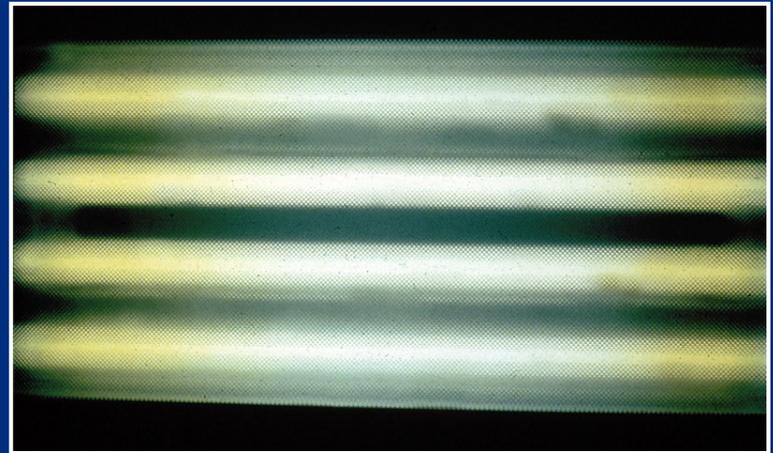


Fixture Inventory

- Counting all: preferred method
 - Better than estimating
 - Takes more time (may not be cost-effective)
- Estimating by fixture density – alternative
 - Do few sample rooms & calculate fixtures/SF
 - Use this value for other rooms like sample rooms
 - Ex: offices, hospital rooms

Identifying & Counting Equipment

- Identify & Count
 - Fixtures of same type
 - Lamps
 - Ballasts
 - Exit signs
 - Controls



Tip: Using convex mirror works well to view lamps and count lamps in fixtures and prevents “stiff neck”



Identifying Bulbs & Tubes

- Look in storeroom
- Look in “nooks & crannies”
- Talk with people who replace them
- May need to open some fixtures



Spotting Night Lights & Emergency Lights



- Some fixtures wired to be on 24/7
 - Wired to emergency power
- Spotting:
 - When room light off, night lights stay on
 - When see conduit from fixture to emergency lighting



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Counting Fixtures

- Grid ceiling
 - Count rows & columns
 - Multiply
- Count fixtures per bay
 - Multiply by number of bays
- Use counting tool for large quantities





Continuous Rows

- Record number of fixtures per row & number of rows
- Information used for planning retrofits using tandem-wired ballasts or bi-level ballasts





Audit Tool: Discriminator

- Electronic replacement for “flicker checker”
- Aim-and-shoot
 - Aim at fixture & press button
 - Red - magnetic ballast
 - Green – electronic
 - \$50 – Sensor Switch
 - >\$300 - Advance



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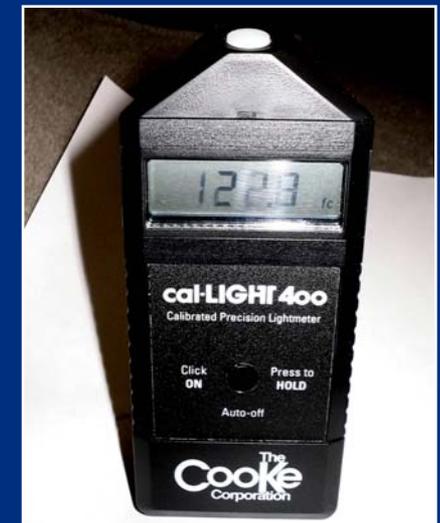
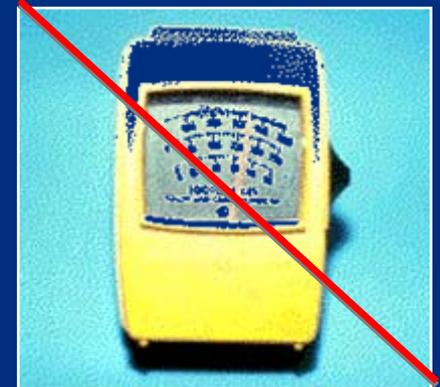
Lighting Power Density (LPD)

- LPD is lighting allowance for building lighting (ASHRAE/IESNA 90.1)
- Measured in watts/SF
 - High efficiency – low LPD
- Good indicator of lighting efficiency & potential savings
- Estimate savings by comparing to state-of-art designs



Audit Tool: Light Meter

- Do NOT use analog meter (+/- 20%!)
 - Is it 60 FC? (or 48? or 72?)
- Use good digital meter
 - +/- 3% or +/- 5%
- Install new batteries for each audit
- Calibrate annually



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Measuring Light Levels

- Survey building spaces & record light levels
- Take measurements at task height:
 - 30” – desks, tables, benches (“workplane”)
 - At floor for corridors & halls
 - Under fixture (max) & half-way between (min)
 - At landing (max) and half-way down stairs (min) in stairwells
- Calculate average from max & min
 - $FC_{avg} = (FC_{max} + FC_{min}) / 2$



Improper Light Levels

- Too high – wastes energy & reduces lighting quality
- Too low – owner liability issue
- Auditor’s liability when “failure to inform”



Data Collection: Interviews

- Key facilities personnel
 - Maintenance staff
 - Building manager
- Helps bridge gaps in data
- Ask questions in direct, but non-threatening way
 - Coffee break area good neutral area
 - Recording information can be intimidating



Retrofit vs. Re-Lighting

- Re-lighting
 - New fixtures are better than old? – Not always
 - Opportunity to optimize efficiency with new fixture
 - Opportunity to change more parameters of system
 - Number of lamps/fixture, number of fixtures/system
 - Can't replace fixtures were have asbestos in ceiling (ACM)
 - More contractors know how to install new fixtures than to retrofit properly



Retrofit vs. Re-Lighting

- Retrofit
 - Reuse old fixtures – OK if old fixture quality fixture
 - Limited change potential
 - Limited to lamp/ballast changes
 - Can be difficult to improve fixture efficiency
 - Can't change type of system
 - Can't change all parameters of lighting system



Closing Advice: Lamps & Ballasts

- Do NOT use T8 lamps on magnetic ballasts
 - Hot lamps, short life, voided warranty
- Do NOT use “energy-efficient” T8 lamps
 - 30-w, 28-w, 25-w
 - Not sustainable
- Use high performance (“super”) T8 systems
 - Most efficient, most sustainable of all fluorescent
 - 3100L lamps + 0.77 BF NEMA Premium ELBs



Closing Advice: Lamps & Ballasts

- Use SEL (spectrally-enhanced lighting)
 - Offices & demanding visual tasks
- Use 6-L “super” T8 & HBF (high power) ELB (1.2) for high bays
- Do NOT use screw-base (SB) CFLs to replace incandescent fixtures
 - NOT sustainable
- Use new CFL (pin-base) fixtures to replace incandescent fixtures

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The HANDBOOK of
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